HYDRAULIC DESIGN ADVISORY
HDA 06-02
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SUBJECT: SCOUR CONSIDERATIONS FOR THREE-SIDED DRAINAGE STRUCTURES

SUPERSEDES – HDA 03-01

AUTHOR: JOHN H. MATTHEWS, PE.
RIVER MECHANICS ENGINEER

For the purposes of addressing scour concerns, VDOT requires that all new three-sided structures (bottomless culverts, precast concrete arches, cast in place concrete frames, corrugated metal plate aches and similar structures) be treated as bridges for any structure proposed under VDOT roadways or under any roadways that may ultimately come under VDOT's jurisdiction, such as subdivision roads. Therefore, all such structures shall be subject to the analysis and documentation requirements outlined in the latest version of the Federal Highway Administration's publication EVALUATING SCOUR AT BRIDGES (HEC-18) and Chapter 12 of the VDOT DRAINAGE MANUAL. Each line of a three-sided structure shall be treated the same as a span of a bridge. In the case of a single line of three-sided structure, the outer walls shall be considered as solid, vertical wall bridge abutments. In the case of multiple lines of a three-sided structure, the outer walls shall be considered as solid, vertical wall bridge abutments and any interior walls or back-to-back walls shall be considered as a single, solid, bridge pier.

A formal hydraulic analysis is required for all three-sided structures in order to assess hydraulic impacts, compute the information needed to perform the scour analysis and document compliance with VDOT hydraulic design requirements. The hydraulic analysis is to be predicated on the procedures presented in the current VDOT DRAINAGE MANUAL in either Chapter 8 (for structures with a combined width of less than 20 feet, not within a FEMA designated Flood Zone or with a 100-year discharge of 500 cfs or less) or Chapter 12 (for structures with a combined width of greater than or equal to 20 feet, located within a FEMA designated Flood Zone or where the 100-year discharge is greater than 500 cfs). When performing a hydraulic analysis for any three-sided structure, regardless of width, it is appropriate to consider the natural channel and flood plain configuration as projecting through the crossing, the same as if it were a bridge spanning a flood plain. For the purpose of determining the hydraulic capacity of the three-sided structure, any of the structure's opening area that is outside the natural channel area, and below the flood plain elevation, will be considered obstructed and not available for hydraulic conveyance.

As discussed in Chapter 12 of the VDOT Drainage Manual, scour is a major concern at all bridge and bridge like crossings. A scour evaluation and report (including all supporting information) shall be included in any three sided structure analysis. If scour countermeasures are proposed at the abutment (outer walls), supporting documentation shall

be included in the scour report. All documentation and analyses shall be reviewed and approved by the District Structure and Bridge Engineer as well as the District Drainage Engineer or District River Mechanics Engineer, as appropriate. The scour report shall include, but is not limited to, a scour evaluation/scour computations, riprap computations and a sufficient number of sampling locations, soil borings (or test pits) and rock cores as appropriate to support the foundation design.

If riprap is to be used as a countermeasure for abutment scour at the outer walls, the horizontal limits of the riprap shall be in accordance with the latest version of the Federal Highway Administration's publication BRIDGE SCOUR AND STREAM INSTABILITY COUNTERMEASURES (HEC-23) and the riprap thickness and bedding shall be in accordance with the current VDOT ROAD AND BRIDGE STANDARDS AND SPECIFICATIONS. No riprap or other scour countermeasures shall be placed in the stream channel or any wetland area unless all appropriate environmental permits have been obtained predicated on such placement. Where riprap or other scour countermeasures are required along the outer walls, it is recommended that the span of the structure be increased to allow for placement of the scour countermeasures outside the stream channel or wetland areas.